

PERSONAL PROTECTIVE EQUIPMENT (PPE) SHORTAGES IN VETERINARY MEDICINE

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Shortages of personal protective equipment (PPE) are of significant concern in some areas because of the COVID-19 pandemic. As PPE supplies dwindle, there must be consideration of PPE conservation practices, alternate PPE management (e.g. re-use of single use items) and alternate PPE (e.g. cloth masks). A key consideration in all cases is whether PPE is designed to protect the user or the veterinary patient. It is more risky to use unproven alternate approaches for items designed to protect veterinary personnel versus to protect patients.

The general approach in times of shortage is to focus first on **conservation**, then **extended use**, then **re-use** of single use items. This varies by the type of PPE.

Gowns

Gowns are used both for protection of the user (e.g. when handling infectious patients) and for protection of the patient during sterile (surgical) procedures. The goal of the gown in each situation should be considered when assessing how to address shortages.

There are three main types of gowns to consider:

- Cloth surgical gowns: These offer excellent protection and are designed to be re-autoclaved and re-used repeatedly.
- Disposable surgical gowns: These offer excellent protection but are not designed to be re-used. They are amenable to extended use but re-use is problematic, mainly because of the risk of contamination during doffing and handling, as described below.
- Disposable procedure gowns: These tend to provide less body coverage (shorter gowns) and are more permeable. While useful for routine, lower risk contact, they offer limited protection against liquids and strike through. They are not designed to be re-used and are likely to be damaged during re-use; therefore, they could be considered for some degree of extended use but not re-use.

For surgical procedures, facilities that have both cloth and disposable gowns should ensure that cloth gowns are used as much as possible to conserve the supply of disposable gowns. Limiting the number of people involved in surgery can also help conserve gowns. For non-surgical use, a quick case-by-case risk assessment to determine whether a gown is truly needed for handling the patient. For example, while use of a gown is indicated when handling a patient at high risk of being infected with or contaminated by a virus such as SARS-CoV-2, routine use of gowns for any patient contact will rapidly and unnecessarily deplete supplies.

Extended use and re-use of gowns are potential options for both surgical and non-surgical procedures. Extended use involves wearing the gown for contact with multiple consecutive patients, without changing. This is a reasonable consideration when working with

animals of the same disease or contamination risk status, or when moving from a lower risk to a higher risk patient. In surgery, since the risk of bloodborne pathogens is limited in veterinary medicine, re-use of a surgical gown for serial procedures is a reasonable consideration. Gowns that are visibly soiled are not good candidates for extended use.

Re-use involves removing a gown, then using it again without decontaminating the gown first. This is not recommended in most cases with gowns that may have come in contact with an infectious animal or materials, because of the potential for contamination of the user's body or clothing when trying to remove a gown in such a way as to maintain it for re-use, contamination of the environment during storage, contamination of people in the vicinity of stored gowns (e.g. inadvertently touching a gown when walking by) and contamination of the user during re-donning. Re-use of gowns worn for a sterile procedure that remain unsoiled can be considered for subsequent non-sterile procedures.

If surgical gowns become unavailable, performing surgical procedures using clean (unused for anything else since laundering) laboratory coats as the protective outwear layer is reasonable, if the surgery cannot be postponed.

Tyvek body suits are uncommonly used in most veterinary clinics, and would be restricted to select high-risk situations. These should not be re-used as they cannot be effectively doffed and re-donned without contamination of wearer and the environment. Extended use for multiple animals of the same risk status is acceptable.

Examination gloves

Examination glove supplies tend to be more stable than most other PPE. Examination gloves should remain single use. They are not designed for extended use, and since gloves are the type of PPE most likely to be contaminated with pathogens, extended use is not recommended, but could be considered in extreme cases if restricted to situations where there was minimal risk of contamination and a limited degree of use (to reduce the risk of glove damage). Repeated use of alcohol hand sanitizer on nitrile or latex examination gloves did not have a demonstrable impact on glove integrity, in one small study.¹

Re-use of examination gloves is not recommended because of the likelihood of damage to the gloves during initial use and the difficulty removing gloves in such a way that the users hands are not contaminated and the gloves can still be re-donned. There are no reported decontamination measures for such gloves and damage to gloves during decontamination attempts seems likely.

Surgical (sterile) gloves

Surgical glove shortages are more likely than examination glove shortages. Glove conservation measures should be used, including limiting or cancelling elective procedures and minimizing the number of people scrubbed into surgery.

As an item mainly used in veterinary medicine mainly to protect the patient from the user, suboptimal practices are easier to justify given the minimal risk to patients that would occur from some logical compromises. The most reasonable approach to lack of surgical gloves is to wear examination gloves (that have a tight seal around the wrist) and apply a surgical waterless hand sanitizer (e.g. Avagard, Sterillium). The surgeon should perform routine pre-surgical hand antisepsis (scrub or rub), then don examination gloves (ideally from a new

package used only in a clean area such as the scrub station or surgical suite), and finally apply the surgical hand sanitizer to the gloved hands.

Surgical masks

Surgical masks may be the most pressing supply shortage during the current COVID-19 pandemic. They are designed as single use, yet are likely able tolerate extended or repeated use, with proper care. The main role of surgical masks in veterinary surgery is to protect the surgical site from respiratory droplets from surgical personnel.

Conservation should be the first priority. This involves limiting elective procedures that require masks, limiting the number of people in the operating room during any procedure, and careful consideration of which personnel can reasonably forego mask use, such as anesthesiologists and surgery technicians who can maintain a reasonable distance from the surgical site and surgical table. Both masked and unmasked personnel should limit talking as much as possible (see below).

Single-use disposable surgical masks can be re-used if they are carefully removed to prevent creasing or tearing of straps and allowed to dry prior to re-use. For hygienic reasons, a mask should only be re-used by the person who used it initially. The number of times a mask can be re-used is unclear. Presumably, masks can be re-used multiple times if handled appropriately. Washing, autoclaving, spraying with disinfectants or other decontamination methods are not recommended because of the potential for damage to mask integrity. Irradiation may be a safe and effective decontamination method,² but is largely impractical.

Re-usable (washable) cloth masks are an alternative for situations where masks are designed to reduce contamination by droplets from the user. Their efficacy is variable and dependent on design and fabric,^{3,4} and cloth masks were shown to be inferior to medical masks for protection of healthcare workers against respiratory disease.⁵ As a means of preventing droplet contamination of a surgical site, cloth masks should provide reasonable protection to the patient. Extended use (multiple procedures on the same day) is likewise reasonable. Cloth masks should be laundered after each day of use. Cloth masks may be inferior to conventional surgical masks for prevention of droplet exposure of the wearer,³ and therefore should not be used in situations where mask use is intended to protect the wearer (e.g. from splashes), unless there are no other mask options. Masks are also sometimes used outside of surgery during patient handling to prevent hand-to-nose/mouth contact. In these cases, cloth masks might still be inferior to single-use surgical masks if the hands are wet, because strikethrough is less of a concern with a surgical masks designed with an outer layer that is meant to repel liquids).

In the absence of any type of mask, a re-usable face shield is likely the next best option for protecting the patient or the wearer (see below). Ideally, face shields used in surgery should cover a reasonable degree of the side of the face and extend below the chin. Face shields presumably provide less protection from respiratory droplets that the surgeon creates. Behavioural changes such as avoiding looking away from the surgical site (exposing the sides of the face to the patient) and limiting talking are important measures to implement if face shields are worn instead of masks. Face shield are fairly effective at preventing droplet exposure of the wearer from droplets during procedures involving a splash risk, and have the added advantage of also protecting the eyes, though they may be somewhat cumbersome.

N95 respirators (masks)

N95 respirators (or masks) are designed to prevent exposure of the user to airborne or aerosolized pathogens, making their use a matter of occupational health and safety rather than patient safety. Indications for use of N95 masks in veterinary practice are limited and conservation is the most important and effective management strategy, to conserve the supply of N95 masks for both veterinary and human healthcare needs. N95 masks should only be used when there is a plausible risk of aerosol exposure to a pathogen, and when full respiratory PPE (including eye protection or a face shield) is being used. Effective use of an N95 mask also requires proper fit testing by certified personnel. An N95 mask will not provide effective protection if it is not properly fitted and the seal checked after donning, or if the individual's face is not clean-shaven.

Extended use of N95 masks involves wearing a mask for more than one patient encounter (without removing in between) and is recommended in periods of shortages by both [CDC](#) and [APIC](#). For extended use, the mask should not be removed, adjusted or touched between patients and contamination should be minimized by avoiding touching the mask at any time. It should be discarded after close proximity to aerosol generating procedures and if it is grossly contaminated or if breathing becomes difficult. Wearing a face shield over the N95 mask should be considered during extended use to reduce mask contamination.

Re-use of N95 masks is not recommended. [CDC has stated that there is no way of determining the number of safe re-uses](#), and multiple donning and doffing can have an eventual impact on mask fit.⁶ Furthermore, since N95 masks are used in situations where aerosol exposure to a pathogen is likely, the potential (or likelihood) of contamination of the external surface is high. This could make the mask a fomite during subsequent removal, handling and re-donning.

If re-use cannot be avoided, [CDC has issued the following recommendations](#):

- Discard N95 respirators following use during aerosol generating procedures.
- Discard N95 respirators contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients.
- Discard N95 respirators following close contact with any patient co-infected with an infectious disease requiring contact precautions.
- Use a cleanable face shield (preferred) or a surgical mask over an N95 respirator and/or other steps (e.g., masking patients, use of engineering controls), when feasible to reduce surface contamination of the respirator.
- Hang used respirators in a designated storage area or keep them in a clean, breathable container such as a paper bag between uses. To minimize potential cross-contamination, store respirators so that they do not touch each other and the person using the respirator is clearly identified. Storage containers should be disposed of or cleaned regularly.
- Clean hands with soap and water or an alcohol-based hand sanitizer before and after touching or adjusting the respirator (if necessary for comfort or to maintain fit).
- Avoid touching the inside of the respirator. If inadvertent contact is made with the inside of the respirator, perform hand hygiene as described above.

- Use a pair of clean (non-sterile) gloves when donning a used N95 respirator and performing a user seal check. Discard gloves after the N95 respirator is donned and any adjustments are made to ensure the respirator is sitting comfortably on your face with a good seal.

No disinfection or decontamination methods have been shown to be effective at eliminating contaminants while not impacting mask integrity. Irradiation is likely effective,² but is not practical and the impact on mask function is unknown. With regard to SARS-CoV-2 specifically, given the limited information about environmental survival, time may be the most effective decontamination method, as survival of only 2-3 days on most surfaces was reported in one experimental study.⁷ However, SARS-CoV-2 was detected for up to 17 days in the environment of a contaminated cruise ship.⁸ It is unclear whether that represents viable, infective virus or merely viral RNA remnants and it does not likely represent true risk of environmental survival.

There are few practical and available alternatives for N95 masks. Powered air-purifying respirators (PAPRs) or N99 respirators are options but are unlikely to be a replacement for N95s if they are not already available in a facility. If N95 masks are indicated but not available, consider whether high risk (i.e. aerosol generating) procedures can and will be performed or if the patient can be referred elsewhere for care.

Face shields

Most face shields used in healthcare are fully disposable or have a re-usable headpiece and disposable visor. They primarily protect the wearer from droplets or splashes and have the advantage of protecting the eyes as well as the nose and mouth. They are less effective at preventing exposure of the patient to respiratory droplets from the wearer, because they are open at the sides and bottom. As with other forms of PPE, conservation is important.

Extended use on multiple patients of the same risk status is less relevant in veterinary medicine because of the uncommon and sporadic need for face shields in most situations.

Re-use is more of a consideration when there are few face shields but a need to use them periodically. Face shields are relatively easy to re-use because the material is easy to disinfect and should withstand multiple rounds of disinfection. Care should be taken to minimize the risk of contamination while removing the face shield. A face shield should be removed with clean hands, either after removal of gloves or after removal of an outer layer of gloves, or after application of hand sanitizer to the gloves. The face shield can then be sprayed or wiped with a disinfectant. The appropriate contact time will often elapse as the rest of the individual's PPE is removed and hand hygiene is performed. A final wipe with disinfectant can then be performed, ensuring all inner and outer surfaces are covered. It is unclear how many times a face shield can be re-used, but with careful handling, it is likely that face shields would tolerate multiple re-uses. Face shields should be inspected before and after each use to ensure there are no visible defects.

Eye protection

Eye protection is uncommonly used in veterinary medicine, so supplies of eye protection tend to be sparse. Eye protection can consist of goggles or face shields (see above) and is indicated when there is the potential for droplet exposure of the face. Eyeglasses are not an acceptable means of eye protection because the eyes are exposed on both sides. Safety glasses with extensions over the side of the eye **are acceptable alternatives** if other routine eye protection is not available.

Goggles are designed to be re-used and can be disinfected after each use. Manufacturer recommendations should be followed, when available. Otherwise, spraying or wiping with a disinfectant (e.g. accelerated hydrogen peroxide) should be effective. The proper contact time for the disinfectant must be provided. Eye protection should be removed with clean hands, either after removal of gloves or after removal of an outer layer of gloves. Disposable eye protection should be discarded, if possible. If re-usable eye protection is not available, disinfection of disposal eye protection could be considered.

During shortages, alternatives to laboratory or medical-use goggles such as snorkel/scuba masks have been proposed for human healthcare.⁹ Most would presumably be as effective as standard medical goggles, although comfort for long term use might be a concern. They are readily available items and amenable to repeated disinfection, and would be a logical replacement for conventional eye protection.

Expired PPE

The use of expired low-use or stockpiled items (especially N95 masks) can be considered when unexpired items are not available. The [US Food and Drug Administration states](#) "FDA believes [these items] may still offer some protection even when they are used beyond the manufacturer's designated shelf life or expiration date. The user should visibly inspect the product prior to use and if there are concerns (such as degraded materials or visible tears) the product should be discarded." () During a shortage, use of expired PPE that is in visibly good shape is reasonable, but it is very important that expired products are kept in their original packaging or clearly labelled so they are not mistaken for unexpired product later on. Use of unexpired product, if available, should be prioritized for the highest risk procedures..

Text Hyperlinks

Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings

<https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html>

FAQs on Shortages of Surgical Masks and Gowns

<https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/faqs-shortages-surgical-masks-and-gowns>

Strategies for Optimizing the Supply of Eye Protection

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/eye-protection.html>

APIC Position Paper: Extending the Use and/or Reusing Respiratory Protection in Healthcare Settings During Disasters.

http://www.apic.org/Resource_/TinyMceFileManager/Advocacy-PDFs/APIC_Position_Ext_the_Use_and_or_Reus_Resp_Prot_in_Hlthcare_Settings12091.pdf

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